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**TIBIAL SIZER**

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## TIBIAL SIZER

1           The present invention relates generally to an instrument for  
2 helping to estimate the appropriate size tibial base plate implanted during knee  
3 arthroplasty surgery. More particularly, the present invention relates to one or  
4 more tibial sizers, and a method of using the sizers, where the sizers are used to  
5 estimate the appropriate size tibial base plate, with respect to both the  
6 anterior/posterior direction and the medial/lateral direction. Additionally, the  
7 preferred embodiment also provides a measurement of the amount of exposed  
8 bone between a posterior proximal portion of the tibia and a posterior edge of  
9 the tibial sizer (which edge will correspond to the posterior edge of the tibial  
10 base plate of the corresponding size).

## BRIEF SUMMARY OF THE INVENTION

11           Briefly, the present invention relates to a tibial sizer for use  
12 during knee arthroplasty. The embodiment described herein is intended to be  
13 utilized during unicompartmental knee arthroplasty (UKA). However, the  
14 concept of the present invention could also be applied to other types of knee  
15 arthroplasty, such as total knee arthroplasty (TKA). The preferred embodiment  
16 of the tibial sizer includes a head and a handle extending outwardly from the  
17 head. There is preferably a channel that extends along the tibial sizer in a  
18 longitudinal direction, through at least a portion of the head and at least a  
19 portion of the handle, with a slider configured and arranged to be slidably  
20 positioned within the channel. In the preferred embodiment, the head includes  
21 posterior, lateral and medial outer peripheral surfaces. The posterior outer

1 peripheral surface is generally flat, and one of the lateral outer peripheral  
2 surface or the medial outer peripheral surface is curved and the other of the  
3 lateral outer peripheral surface and the medial outer peripheral surface is  
4 generally flat and includes a cutout portion therein.

5 Several sets of markings are preferably provided on the tibial  
6 sizer. There is preferably a first set of markings for indicating the amount of  
7 exposed bone between a posterior proximal portion of a tibia and a posterior  
8 edge of the head of the tibial sizer. Additionally, there is also preferably a  
9 second set of markings for indicating a suggested size of tibial base plate with  
10 respect to an anterior/posterior direction, which markings are used when the  
11 slider is inserted into the channel of the tibial sizer. Optionally, the slider may  
12 be configured to be used, for some measurements, without being inserted into  
13 the channel. For this feature, the slider includes a third set of markings that  
14 comprise indicia representing different sizes of tibial base plates, wherein the  
15 third set of markings are for determining a suggested size of tibial base plate,  
16 with respect to the anterior/posterior direction, when the slider is used without  
17 being inserted into the tibial sizer.

18 The present invention also relates to a method of using the tibial  
19 sizer, as well as to a system of tibial sizers of a plurality of different sizes.  
20 Preferably, the system of sizers only includes a single slider, which can be used  
21 with each of the sizers, or the slider can also be used alone (for certain  
22 measurements).

#### BRIEF DESCRIPTION OF THE DRAWINGS

23 Preferred embodiments of the present invention are described  
24 herein with reference to the drawings wherein:

25 Figure 1 is a perspective view of one side of one preferred  
26 embodiment of the tibial sizer of the present invention, shown with the slider  
27 inserted into the channel;

Figure 2 is a perspective view of the tibial sizer of Figure 1, shown from the opposite side and without the slider;

Figure 3 is a cross-sectional view of the tibial sizer of Figure 1, taken along line III-III of Figure 2, showing the channel for receiving the slider;

Figure 4 is a perspective view of the slider, without the remainder of the tibial sizer;

Figure 5 is a view of a resected tibia, shown with an example of a tibial base plate of a unicompartmental knee prosthesis; and

Figure 6 is a view of the tibial sizer of Figure 1 positioned upon the cut surface of a resected tibia.

## DETAILED DESCRIPTION OF THE INVENTION

Turning now to Figures 1 and 2, a preferred embodiment of the present tibial sizer 10 is shown. The sizer includes a head 12 and a handle 14, as well as a separate slider 16 that is configured to slide within the head and handle. Turning first to the head 12, the outer periphery of the head is shaped to correspond to the outer periphery of a tibial base plate, one example of which is shown in Figure 5 and is designated as base plate 18. In the depicted example, tibial base plate 18 is configured for use with a plastic insert 20. However, the present invention may also be used with other types of tibial base plates, such as those of unitary construction whereby the insert is not a separate component. As shown in Figure 5, the tibial base plate 18 is intended to be implanted into the resected portion 21 of a tibia 24.

The tibial sizer 10 is capable of being used on both the left and the right tibia, and on either the medial compartment or the lateral compartment of either tibia. However, for the sake of convenience in description, the tibial sizer will primarily be shown and described with respect to the medial compartment of the right tibia, and the terms lateral, medial, etc. relative to the right tibia will be used. Of course, if the prosthesis was being implanted into

1 the left tibia, the surfaces on the prosthesis and the tibial sizer designated as  
2 lateral and medial would be reversed.

3 Figure 1 shows the tibial sizer 10 as it would be positioned for  
4 use in the medial compartment of the right tibia, and Figure 6 shows the tibial  
5 sizer in such a position. Head 12 includes a curved outer peripheral surface 22  
6 connected to a generally flat posterior outer peripheral surface 24, which is  
7 itself connected to another generally flat outer peripheral surface 26. In this  
8 orientation (for use with the medial compartment of the right tibia), the curved  
9 outer peripheral surface 22 is the medial outer peripheral surface of head 12,  
10 and surface 26 is the lateral outer peripheral surface of the head. Optionally,  
11 the generally flat lateral outer peripheral surface 26 includes a cutout portion  
12 28, which can be used as a guide to create a cut, or to mark the position of a cut,  
13 to accommodate a keel on a tibial implant (such as keel 29 shown in Figure 5),  
14 as described more fully below.

15 The outer peripheral surfaces 22, 24, and 26 of the tibial sizer are  
16 shaped and sized like the corresponding outer peripheral surfaces of the tibial  
17 base plate 18 of Figure 5. More specifically, curved outer peripheral surface 22  
18 of the sizer 10 (Figure 1) corresponds to curved outer peripheral surface 22' of  
19 base plate 18 (Figure 5) and generally flat outer peripheral surface 26 of the  
20 sizer 10 (Figure 1) corresponds to generally flat outer peripheral surface 26' of  
21 base plate 18 (Figure 5). Additionally, generally flat posterior outer peripheral  
22 surface 24 of the sizer 10 corresponds to the generally flat posterior outer  
23 peripheral surface of the base plate 18 (which surface is hidden from view in  
24 Figure 5).

25 In order to accommodate the range of sizes of tibial base plates,  
26 there should be a set of tibial sizers with heads 12 of a variety of different sizes,  
27 with one head corresponding in size to each size of tibial base plate 18. For  
28 example, if there are six different sizes of tibial base plate 18, there should be  
29 six different sizes of tibial sizer 10. In order to readily show the size of a  
30 particular tibial sizer, size markings such as markings 30 and 30' should be

1 provided on at least one location, and preferably at two locations, as shown in  
2 Figure 1. Further, the size markings 30/30' should coincide with the size  
3 markings on the tibial base plates. For example, where there are six different  
4 sizes of tibial base plate to select from, designated as "Size 1", "Size 2", "Size  
5 3", "Size 4", "Size 5" and "Size 6", the six corresponding tibial sizers 10  
6 should also be designated as "Size 1", "Size 2", etc.

7           Although different sizes of tibial sizers should be provided, each  
8 sizer can be used for any one of the four compartments (i.e., lateral  
9 compartment of the right tibia, medial compartment of the right tibia, lateral  
10 compartment of the left tibia, and medial compartment of the left tibia). More  
11 specifically, the orientation shown in Figure 1 is used for the medial  
12 compartment of the right tibia and for the lateral compartment of the left tibia;  
13 and the orientation shown in Figure 2 (which is merely the slider of Figure 1  
14 turned upside down) is used for lateral compartment of the right tibia and for  
15 the medial compartment of the left tibia.

16           In use, to determine the proper size tibial base plate to be  
17 implanted, different sized sizers 10 are placed on the resected portion 21  
18 (Figure 5) of the tibia 24, as shown in Figure 6. The tibial sizer 10 should be  
19 placed with the flat outer peripheral surface 26 (which in this case is the lateral  
20 surface, since Figure 5 shows the right tibia 24) against the surface 32 created  
21 by the sagittal cut. The tibial sizer 10 of the size that best covers the resected  
22 proximal tibia, without any overhang, should be selected. Care should be taken  
23 to ensure that the selected tibial sizer rests on cortical bone around its entire  
24 perimeter, without any overhang of the head 12, in order to ensure that the tibial  
25 base plate has strong cortical support.

26           The present tibial sizer 10 also includes a feature for measuring  
27 the amount of exposed bone posterior to the sizer, as well as including  
28 markings for providing a suggested size of tibial base plate with regard to the  
29 anterior/posterior direction. This anterior/posterior size suggestion provided by  
30 the markings described below should be used in conjunction with the

1 anterior/posterior size estimate provided by matching the size of the head 12 (in  
2 the anterior/posterior direction) with the size of the resected portion 21 of the  
3 tibia, as described above. In the preferred embodiment of the present invention,  
4 the size estimate in the medial/lateral direction is provided by matching the size  
5 of the head 12 (in the medial/lateral direction) with the size of the resected  
6 portion 21 of the tibia, as described above.

7 The amount of exposed bone posterior to the sizer is indicated by  
8 the slider 16, which is shown inserted into the sizer 10 in Figure 1, and is  
9 shown removed from the sizer in Figure 4. The slider 16 is configured to slide  
10 within a channel 34 (Figure 2) that extends along the longitudinal direction of  
11 both the head 12 and the handle 14. Figure 3 shows a cross-sectional view of  
12 the handle 14 taken along lines III-III of Figure 2. This cross-sectional view  
13 clearly shows the channel 34, which also includes upper lips 36 for maintaining  
14 the slider 16 within the channel 34. The channel 34 is preferably configured to  
15 allow for the slider 16 to be easily removed, such as by simply pulling the slider  
16 out of the channel via a hook portion 38.

17 As mentioned above, the present invention relates to a set of  
18 different sized tibial sizers 10, with one sizer sized to correspond to each  
19 available size of tibial base plate 18. Optionally, one slider 16 may be provided  
20 for each tibial sizer 10. In the alternative, only one slider 16 could be provided  
21 for all of the different sized tibial sizers. Thus, for example, if a set of tibial  
22 sizers includes heads 12 of six different sizes, the single slider 16 provided with  
23 the set could be configured to fit all of the sizers, and it could simply be moved  
24 into the channel of the sizer being used. Preferably, the slider (or sliders) and  
25 the sizers are all made of stainless steel, although other materials are also  
26 contemplated as being within the scope of the invention.

27 The hook portion 38 of the slider 16 is configured to make  
28 contact with a posterior proximal portion 40 of the tibia 24 (see Figure 5).  
29 When the slider 16 is inserted into the channel 34, and with the hook portion 38  
30 making contact with the posterior proximal portion 40 and the head 12 properly

1 aligned on the resected portion 21, two different sets of markings may be used -  
2 - one set for indicating the amount of exposed bone posterior to the sizer; and  
3 another set for providing a suggested size of tibial base plate, with respect to  
4 the anterior/posterior direction. As shown in Figures 1 and 6, the first set of  
5 markings, designated as markings 42, indicate the amount of exposed bone  
6 between the posterior proximal portion 40 of the tibia 24 and the posterior outer  
7 peripheral surface 24 of the tibial sizer 10. More specifically, markings 42 are  
8 located on the slider 16, and provide the indication of exposed bone when  
9 viewed with respect to edge 44 of the handle 14 of the sizer 10. In the  
10 embodiment shown, markings 42 are provided in millimeters, between 0mm  
11 and 20mm, in 2mm increments. Of course, any desired units may be used, and  
12 other increments between units are also contemplated. Markings 42, as well as  
13 the other types of markings described herein may be produced upon the sizer by  
14 a variety of different methods, such as laser etching, engraving, printing, etc.

15 The second set of markings, designated as markings 46 in Figures  
16 1 and 6, provide a suggested size of tibial base plate, with respect to the  
17 anterior/posterior direction. Markings 46 include indicia on the handle 14  
18 representing different sizes of tibial base plates and a pointer 48 on the slider 16  
19 for pointing to indicate a suggested size of tibial base plate, with respect to the  
20 anterior/posterior direction and with the amount of exposed bone indicated by  
21 the first set of markings 42. As can be seen in Figures 1 and 6, the pointer 48 is  
22 visible through a window 49 that is provided in the handle 14. However, when  
23 the tibial sizer 10 is used in the orientation shown in Figure 2, a window is  
24 unnecessary because channel 34 is open on this side of the sizer. In the  
25 example shown in Figures 1 and 6, there are six different sizes of tibial base  
26 plates (numbered from 1 to 6). However, a different amount and/or a different  
27 type of indicia may be provided if the number of tibial base plates is different  
28 from six and/or if the different sizes of tibial base plates are represented by a  
29 different designation system, such as alphabetically.

1                   In use, the second set of markings 46 operates as follows. The  
2 head 12 of the appropriately sized tibial sizer 10 is positioned on the resected  
3 portion 21 of the tibia, with the flat outer peripheral surface 26 against the  
4 surface 32 created by the sagittal cut (Figures 5 and 6). The head 12 should be  
5 aligned so that its outer peripheral surfaces 22 and 24 do not extend beyond the  
6 bone, but instead rest on cortical bone, as mentioned above. If the outer  
7 peripheral surfaces 22 or 24 do extend beyond the bone, a smaller sizer should  
8 be selected. On the other hand, if the head 12 is so small that outer peripheral  
9 surfaces 22 and/or 24 are too small to rest on cortical bone, a larger sizer should  
10 be selected. After aligning the head 12 of the properly sized sizer 10, the slider  
11 16 is slid within the channel 34 until the hook portion 38 makes contact with  
12 the posterior proximal portion 40 (Figure 5) of the tibia 24. In order to  
13 facilitate gripping the slider, the slider 16 may optionally include a series of  
14 indentations 54 on the lateral and medial edges. With the hook portion 38  
15 contacting posterior proximal portion 40, the pointer 48 on the slider 16 will  
16 point to indicia 46 on the handle 14 to suggest a size of tibial base plate, with  
17 respect to the anterior/posterior direction and with the amount of exposed bone  
18 indicated by the first set of markings 42. If a different amount of exposed bone  
19 is desired, the sizer 10 should be moved in the appropriate direction (i.e., the  
20 anterior direction or the posterior direction), and a different size of tibial base  
21 plate may be suggested (depending upon how much the amount of exposed  
22 bone is changed). The information provided by the second set of markings 46  
23 (which provides size information for the anterior/posterior direction only)  
24 should be used in conjunction with the visual indication of the suggested size of  
25 tibial base plate from the head 12 being positioned on the resected portion 21 of  
26 the tibia (which provides size information for both the anterior/posterior  
27 direction and the medial/lateral direction) to select a tibial base plate of an  
28 appropriate size.

29                   Optionally, the slider may also include a third set of markings  
30 representing different sizes of tibial base plates indicating a suggested size of

1 tibial base plate (with respect to the anterior/posterior direction), where the  
2 third set of markings are only usable if the slider 16 is used by itself, such as  
3 shown in Figure 4. The third set of markings, designated as markings 50 in  
4 Figure 4, includes the same indicia as the second set of markings 46 (except  
5 without the pointer 48). Thus, for example, the third set of markings 50 may be  
6 the numbers 1 through 6, which correspond to different sizes of tibial base  
7 plates. Of course, indicia other than the numbers 1 through 6 may also be used  
8 for the third set of markings.

9 In use, the third set of markings 50, which are visible when the  
10 slider 16 is used alone, operate as follows. The slider 16 (Figure 4) is  
11 positioned upon the resected portion 21 (Figure 5) of the tibia, with its hook  
12 portion 38 contacting the posterior proximal portion 40 of the tibia 24. The size  
13 of tibial base plate indicated by the one of the markings 50 closest to the  
14 anterior proximal portion 52 (Figure 5) of the tibia 24 is the suggested size of  
15 tibial base plate, with respect to the anterior/posterior direction. Using the slider  
16 alone does not provide information for a suggested size of tibial base plate with  
17 respect to the medial/lateral direction, nor does it provide information regarding  
18 the amount of exposed bone between a posterior proximal portion of the tibia  
19 and a posterior edge of the head the tibial sizer (and/or the tibial base plate).

20 To facilitate understanding of the present invention, a brief  
21 description of the use of a set of tibial sizers will be provided next. Although  
22 this description will refer to unicompartmental knee arthroplasty (UKA) of the  
23 medial compartment of the right tibia, the tibial sizers of the present invention  
24 are also configured to be used on the lateral compartment of the right tibia (by  
25 orienting the sizer 10 as shown in Figure 2), as well as on the lateral  
26 compartment of the left tibia (Figure 1 orientation) and the medial compartment  
27 of the left tibia (Figure 2 orientation). As mentioned earlier, the concepts of the  
28 present invention may also be applied to other types of knee surgery, such as  
29 total knee arthroplasty (TKA).

1                   After the tibia has been resected, as shown in Figure 5, the  
2   surgeon views the resected portion 21 and roughly estimates the appropriate  
3   size of tibial base plate needed, and selects (from a set of tibial sizers of  
4   different sizes) a tibial sizer 10 of a size that corresponds to a tibial base plate  
5   of the estimated size. As shown in Figure 6, the surgeon then places the head  
6   12 of the selected tibial sizer 10 on the cut surface 21 of the resected tibia so  
7   that the generally flat outer peripheral surface 26 (i.e., the lateral surface) of the  
8   head 12 of the tibial sizer 10 is against a surface 32 created by a sagittal cut.  
9   Next, the surgeon verifies that the outer medial periphery 22 of the head 12  
10   sufficiently covers the resected tibia, without extending beyond cortical bone 23  
11   (Figure 5). If the outer medial periphery 22 of the head 12 does not provide  
12   appropriate coverage, the surgeon selects another tibial sizer 10 of a different  
13   size, and performs the verifying step again with the newly selected tibial sizer.  
14   If necessary, additional sizers are selected until the appropriate size has been  
15   found.

16                   When the appropriate size of tibial sizer has been found, the  
17   slider 16 is inserted into the channel 34. Of course, the slider may be inserted  
18   into the channel earlier, if desired. With the slider 16 within the channel 34, the  
19   slider is slid until the hook 38 found on a slider 16 contacts a posterior edge 40  
20   of the tibia 24. The surgeon then views a first set of markings 42 that indicate  
21   the amount of exposed bone between the posterior proximal portion 40 of the  
22   tibia 24 and the posterior edge 24 of the head 12 of the tibial sizer 10. If the  
23   amount of bone exposed is too high or too low, the surgeon may choose to  
24   select a different size tibial base plate than the size that corresponds to the tibial  
25   sizer being used. If a size change is needed, the steps described may be  
26   repeated with a sizer that corresponds to the newly chosen size.

27                   In addition to viewing the way the head 12 corresponds to the  
28   resected portion 21 of the tibia, additional information about a suggested size of  
29   tibial base plate, with respect to the anterior/posterior direction, is provided by  
30   the surgeon's viewing of a second set of markings 46. The surgeon considers

1 the position of the pointer 48 along indicia 46, which indicates suggested  
2 different sizes of tibial base plates for the amount of exposed bone indicated by  
3 the first set of markings 42. Finally, in light of the sizing information obtained  
4 by the surgeon when: (1) viewing the correspondence between the head 12 and  
5 the resected portion 21; (2) considering the amount of exposed bone indicated  
6 by markings 42; and (3) considering the suggested size of tibial base plate, with  
7 respect to the anterior/posterior direction, indicated by markings 46, the  
8 surgeon determines the appropriate size of tibial base plate to use. Then, the  
9 tibial base plate of the selected size is implanted using any desired method, and  
10 the arthroplasty continues as known to those of ordinary skill in the art.

11 If desired, the surgeon may also opt to use the cutout portion 28  
12 on the head 12 of the tibial sizer 10 as a guide for either marking a desired  
13 location of a cut to accept a keel (such as keel 29 of Figure 5) of the tibial  
14 implant or for directly creating a cut to accept the keel 29. More specifically,  
15 the head 12 of the sizer is positioned on the resected portion 21 (Figure 5) of  
16 the tibia, and it is properly aligned, as shown in Figure 6. If marking is desired,  
17 the surgeon merely uses the cutout portion 28 as a guide to mark the bone,  
18 using known marking methods, and the bone is then cut or punched using  
19 known methods, where it was marked, in order to provide a space 31 for the  
20 keel 29 of the tibial implant. On the other hand, if the surgeon wants to directly  
21 cut the space 31 for the keel 29, he/she may use the cutout portion 28 directly  
22 for guiding the saw blade used to make the space for the keel.

23 While various embodiments of the present invention have been  
24 shown and described, it should be understood that other modifications,  
25 substitutions and alternatives may be apparent to one of ordinary skill in the art.  
26 Such modifications, substitutions and alternatives can be made without  
27 departing from the spirit and scope of the invention, which should be  
28 determined from the appended claims.

29 Various features of the invention are set forth in the appended  
30 claims.